FAA-E-2900E
September 30, 2003

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SPECIFICATION

Integrated Terminal Weather System
(ITWS)

TABLE OF CONTENTS

Figures and Tables

(This Page Intentionally Left Blank)

1. SCOPE

1.1 Identification. This specification establishes the performance, functional, development, and test requirements for the Integrated Terminal Weather System (ITWS).

1.2 System Overview.

a. The ITWS is a development effort initiated by the Federal Aviation Administration (FAA) to produce a fully automated, integrated terminal weather information system to improve the safety, efficiency, and capacity of terminal area aviation operations. The ITWS will acquire data from FAA and National Weather Service (NWS) sensors as well as from aircraft in flight in the terminal area. The ITWS will provide aviation-oriented weather products to Air Traffic Control (ATC) personnel that are immediately usable without further meteorological interpretation. These products include current terminal area weather conditions and short-term predictions of significant weather phenomena.

b. The ITWS consists of a number of elements which must be identified, acquired or developed, and properly integrated to provide the required capability. These elements include, but are not limited to, weather data processing algorithm software, computer processing and communications hardware and interconnecting links, connections to external sensors and data sources, and dissemination of products to displays or communication ports.

1.3 Document Overview. This document is divided into six (6) sections. Section 1 provides an introduction to the ITWS, its concept of operations, and the functions that it must perform. Section 2 lists the documents which are referenced by this specification. Section 3 contains a high level description of the system and the detailed functional and performance requirements which the ITWS must meet. Section 4 addresses verification requirements and traceability. Section 5 is reserved and Section 6 contains acronyms, abbreviations, and definitions.

1.4 Operational Concept.

a. The end-users of ITWS outputs are Air Traffic personnel in Airport Traffic Control Towers (ATCTs), Terminal Radar Approach Control (TRACON) facilities, and Air Route Traffic Control Centers (ARTCCs); meteorologists in Center Weather Service Units (CWSUs) at the ARTCCs; and pilots. The ITWS will automatically generate a set of

weather products from data and products produced by a variety of weather sensor processors.

b. Identification of weather impacts specific to approach and departure corridors, cornerposts, runways, and airport surface will enable more efficient coordination of routing strategies. ATC personnel will be able to anticipate rather than just react to these weather impacts and will be able to coordinate the movement of traffic through alternate arrival/departure routes resulting in overall increases in capacity. The ability to anticipate impacts such as the movement of significant weather into or out of the area, and then to select optimal routes or determine holding strategies prior to arrival in the area, will result in savings of time and fuel.

1.5 ITWS Functional Areas. The ITWS requirements are categorized by the following major functional areas:

a. Data and Product Acquisition,

b. Product Generation,

c. Display and Computer/Human Interface (CHI),

d. Product Dissemination, and

e. System Control and Support.

1.5.1 Data and Product Acquisition. The Data and Product Acquisition function will be responsible for automatically receiving data and products from external systems and certain end-users. Subfunctions may include, but are not limited to, establishing and managing input data communications links, converting data formats, and converting coordinate systems.

1.5.2 Product Generation. The Product Generation function will be responsible for automatically processing acquired data and products, and producing the ITWS products.

1.5.3 Display and CHI. The Display and CHI function will be responsible for the visual presentation (graphical and textual) on situation displays (SDs) and ribbon display terminals (RBDTs), and audio presentation (audible alarm) on RBDTs of ITWS products to selected users; as well as the acceptance of user input for purposes of display tailoring and control, product selection, and for generation of operations-specific products.

1.5.4 Product Dissemination. The Product Dissemination function will be responsible for automatically exporting ITWS products to external systems. Subfunctions may include, but are

not limited to, establishing and managing output communications links, converting data formats, and converting coordinate systems.

1.5.5 System Control and Support. The System Control and Support function will be responsible for all system functions not allocated to Data and Product Acquisition, Product Generation, Product Dissemination, or Product Display and CHI. Subfunctions may include, but are not limited to, recording of acquired input data and products, archiving of generated products, playback of input data and products, playback of archived products, logging of system operations, management of system time reference, management of site adaptation data, and Remote Monitoring Subsystem (RMS) functions.

(This Page Intentionally Left Blank)

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents, of the exact issue called out in this specification, form a part of this specification to the extent specified herein. If an exact issue is not called out in this specification, then the issue contained in the contract forms a part of this specification to the extent specified herein. In the event of conflict between the following documents and this specification, this specification shall be the superseding requirement, except for the ITWS Contract.

FAA Specifications.

FAA-G-2100G	Electronic Equipment, General Requirements

FAA Interface Documents.

NAS-IC-31053102	TDWR/Low-Level Wind Shear Alert System (LLWAS)
NAS-IC-31058603	TDWR/Base Data Recorder
NAS-IC-TBD	Item Number TWIP 005A-002 Terminal Weather Information for Pilots (TWIP) Enhancement to the Terminal Doppler Weather Radar (TDWR) System TDWR/National Airspace Data Interchange Network (NADIN) Interface Control Document
NAS-IC-25082514	AWOS Data Acquisition System to the Integrated Terminal Weather System (ADAS/ITWS)
NAS-IR-31052514	Part 1, Terminal Doppler Weather Radar (TDWR) Radar Products Generator (RPG) to Integrated Terminal Weather System (TDWR RPG/ITWS)
NAS-IR-31052514	Part 2, Terminal Doppler Weather Radar (TDWR) Product Generator to Integrated Terminal Weather System Situation Display (TDWR RPG/ITWS SD)
NAS-IR-34032514	Airport Surveillance Radar - Model 9 (ASR-9) to Integrated Terminal Weather System (ITWS) ASR-9/ITWS
NAS-IR-TBD	Digital Airport Surveillance Radar – Model 11 (ASR-11) to Integrated Terminal Weather System (ITWS) ASR-11/ITWS
NAS-IC-43020001	National Airspace Data Interchange Network X.25 Packet Mode Users
NAS-IR-61002514	Air Route Traffic Control Center (ARTCC) to ITWS (Facility Interface Requirements Document (IRD) for ARTCC)
NAS-IR-63002514	ATCT/TRACON to ITWS (Facility IRD for TRACON and ATCT)
NAS-IR-94142514	FAA Bulk Weather Telecommunications Gateway (FBWTG) to Integrated Terminal Weather System (ITWS)
NAS-MD-790, SCN-1	Interface Control Document, Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrators

NAS-MD-793A	Remote Maintenance Monitoring System Remote Monitoring Subsystem Requirements

FAA Publications.

DOT/FAA/ND-95/10	Integrated Terminal Weather System (ITWS) Display Description
DOT/FAA/ND-95/11	Integrated Terminal Weather System (ITWS) Algorithm Description

Military Specifications.

MIL-HDBK-454	General Guidelines for Electronic Equipment
MIL-HDBK-505	Definitions of Item Levels, Item Exchangeability, Models and Related Terms
MIL-PRF-49506	Logistics Management Information

Other Publications.

2620001A	Interface Control Document for RPG/Associated PUP
DTFA01-97-C-00006	ITWS Contract

Standards.

IETF Standard 5/RFC-791	Internet Protocol, September, 1981. (Also RFC-792, RFC-950, RFC-919, RFC-922, RFC-1112)
IETF Standard 7/RFC-793	Transmission Control Protocol, September 1981
IETF Standard 41/RFC-894	Standard for Transmission of IP Datagrams over Ethernet Networks, April 1984
IEEE 802.3	Carrier Sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications
RFC 1661	Point-to-Point Protocol (PPP), July 1994
RFC 1662	PPP in HDLC-like Framing, July 1994
EIA-530-A	High Speed 25-Position Interface for Data Terminal Equipment [DTE] and Data Circuit Terminating Equipment [DCE], June 1992

2.2 Non-Government Documents. The following documents, of the exact issue called out in this specification, form a part of this specification to the extent specified herein. If an exact issue is not called out in this specification, then the issue contained in the contract forms a part of this specification to the extent specified herein. In the event of conflict between the following documents and this specification, this specification shall be the superseding requirement, except for the ITWS Contract.

Other Publications.

APD-250M045/APD-250M060 Plasma Display Monitor/Alarm System Instruction Manual (for the Ribbon Display Terminal (RBDT))
Integrated Terminal Weather System (ITWS) Master Test Plan, CDRL C001-01B, Raytheon Company, Air Traffic Management Systems

2.3 Obtaining Copies Of Documents.

a. Copies of FAA specifications and interface documents may be obtained from the Federal Aviation Administration, Headquarters Public Inquiry Center APA-230, 800 Independence Avenue SW, Washington, DC 20591, 202-267-3484. Requests should fully identify material desired and cite the solicitation or contract number.

b. Requests for copies of documents not covered in the preceding section should be addressed to the Contracting Officer in the FAA office issuing the contract. Requests should fully identify material desired and cite the solicitation or contract number.

(This Page Intentionally Left Blank)

3. REQUIREMENTS

3.1 System Definition. Figure 1 provides a top-level overview of the ITWS as a component of the National Airspace System (NAS). It depicts the systems exchanging data and products with the ITWS, and its operational users. The main components of the ITWS will be a Product Generator (PG), and multiple SDs and associated RBDTs.

a. The ITWS will acquire data from external systems, which provide radar, sensor and NWS data. Specified data sets from NWS will be acquired at one (1) designated ITWS location and transmitted to the other ITWS PG sites via government furnished equipment (GFE) communications. The ITWS will merge and process the acquired data sets and provide weather products on displays for ATC personnel. The ITWS will also provide products at designated output ports for access by data link processing and transmission systems to aircraft, and for external users. The ITWS will provide products to some external users by direct connection. The ITWS will also provide products to the Volpe National Transportation Center (VNTSC) where these products can be accessed by qualifying users. The ITWS will ensure that only designated external users will have direct access to ITWS. Access to ITWS products via VNTSC by users is controlled strictly by Memoranda of Agreements between VNTSC and the qualified user. Inter-facility communications will be provided as GFE, either via the National Airspace Data Interchange Network-II (NADIN-II), a national packet switching network, or over point-to-point terrestrial communications lines. For product distribution to remote SDs, the ITWS will use a GFE wide area Internet Protocol (IP) network. IP addresses are provided as GFI. The connection to NWS will be provided via GFE FAA Bulk Weather Telecommunications Gateway (FBWTG) service to the National Weather Service Filter Unit (NFU). The NFU will extract portions of the NWS data for each ITWS.

b. The PG, to be located in 34 specified TRACON/Center Radar Approach Control (CERAP) equipment rooms and three (3) support sites (i.e., William J. Hughes Technical Center (WJHTC), Program Support Facility (PSF), and FAA Academy (FAAAC)), will consist of the processing equipment, which executes GFE weather product algorithms. The PG interfaces to external systems, the NFU, and the SDs.

c. The SD will be a color graphics and alphanumeric display used to display the weather products. The SD will replace the Terminal Doppler Weather Radar (TDWR) Geographic Situation Display (GSD). SDs will be located

at the following operational sites: 49 ATCTs, 37 TRACONs/ CERAPs, and 18 ARTCCs. SDs will also be provided to three (3) support sites (i.e., WJHTC, PSF, and FAAAC). The RBDT will be a GFE alphanumeric display used to display weather products received from the SD. The SDs located in the TRACON operational area will support the TRACON supervisors and Traffic Management personnel, while the SD located in the ATCT operational area will support the ATCT supervisor. The RBDTs located in the TRACON and ATCT operational areas will support the TRACON and ATCT controllers, respectively. The SDs located in the ARTCC operational area will support the Traffic Management Unit (TMU) and CWSU personnel.

d. The ITWS will have backup configurations in the event of data loss from the PG to the SDs. These backup configurations will allow some SDs to receive data from the TDWR and Low Level Wind Shear Alert System (LLWAS III) directly. In the event of data loss from the ITWS PG, the SD will use TDWR as the backup system, while in the event of data loss from both the ITWS PG and TDWR, the SD will use LLWAS III as the backup system. When ITWS is using TDWR as the backup system, only SDs at the ATCT and TRACON supervisor and traffic management positions will acquire TDWR data, and both the SDs and RBDTs will display TDWR data (this includes LLWAS III products or Airport Wind). When ITWS is using LLWAS III as the backup system, only SDs at the ATCT supervisor positions supported by LLWAS III will acquire LLWAS III data, and both the SDs and RBDTs will display the LLWAS III data.

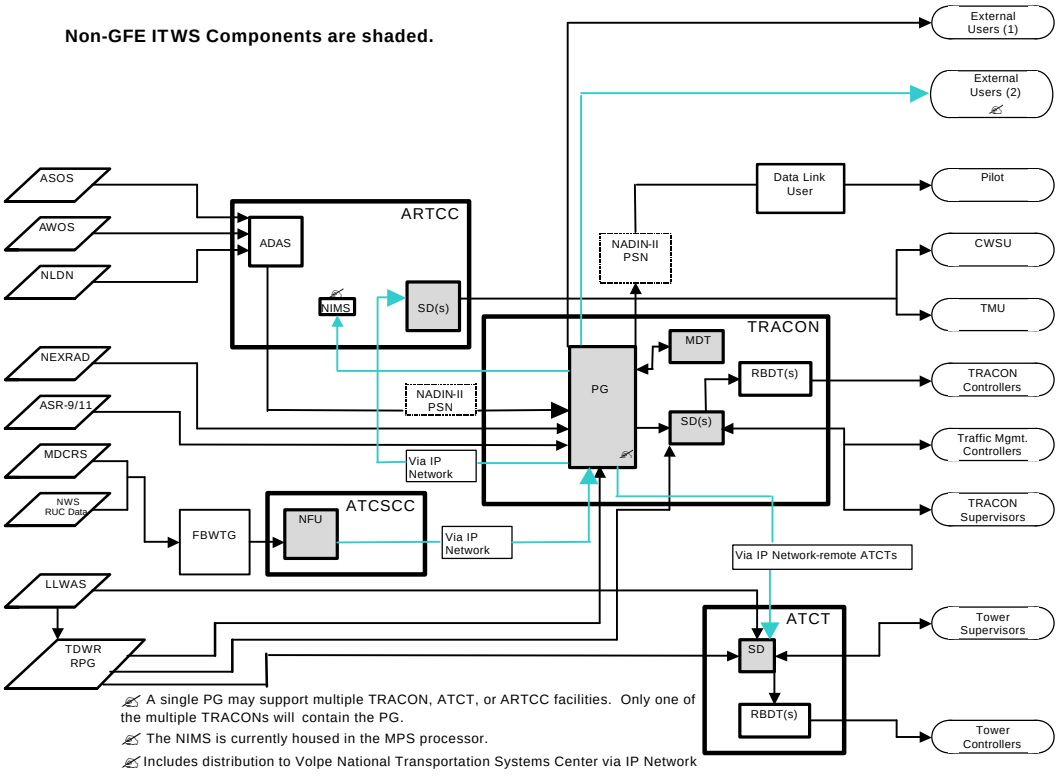

Figure 1. Top Level Overview of the ITWS

ADAS	AWOS Data Acquisition System
ARTCC	Air Route Traffic Control Center
ATCSCC	Air Traffic Control System Command Center
ASOS	Automated Surface Observing System
ASR-9	Airport Surveillance Radar-Model 9
ASR-11	Digital Airport Surveillance Radar (DASR) – Model 11
ATCT	Airport Traffic Control Tower
AWOS	Automated Weather Observing System
CWSU	Center Weather Service Unit
FBWTG	Federal Aviation Administration Bulk Weather Telecommunications Gateway
GFE	Government Furnished Equipment
LLWAS	Low Level Wind Shear Alert System
MDCRS	Meteorological Data Collection and Reporting System
MDT	Maintenance Data Terminal
NADIN-II PSN	National Airspace Data Interchange Network-II Packet Switching Network
NEXRAD	Next-Generation Weather Radar
NFU	NWS Filter Unit
NIMS	NAS Infrastructure Management System
NLDN	National Lightning Detection Network
NWS	National Weather Service
PG	Product Generator
PSN	Packet Switching Network
RBDT	Ribbon Display Terminal
RPG	Radar Products Generator
RUC	Rapid Update Cycle
SD	Situation Display
TDWR	Terminal Doppler Weather Radar
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control Facility

3.1.1 Mission. A number of FAA and NWS weather sensors and systems have been developed which collectively provide large amounts of weather data. However, one of the shortcomings in present operations is that interpretation of some of this data must be performed manually by ATC personnel who are not trained meteorologists. These interpretive efforts are labor-intensive and interfere with the primary ATC. Another shortcoming is the lack of short-term predictions of changes in adverse weather conditions which affect safety, efficiency, and capacity of air traffic operations. The ITWS is intended to eliminate these shortcomings by providing:

a. Improved weather displays to air traffic personnel in ATCTs, TRACONs, and ARTCCs;

b. Shared situational awareness between the air traffic personnel in different locations and with the meteorologists in CWSUs;

c. Information to traffic managers concerning the impact of adverse weather upon air traffic routes for approach/departure route and runway planning;

d. Flight safety products to an ITWS communications port, for possible transmission to aircraft (by a separate, external system);

e. Weather information to ITWS communications ports for access by FAA terminal automation systems, the NWS, or others; and

f. Consistent weather information to all users.

3.1.2 System Modes. The ITWS shall have separate, mutually independent modes for product generation and product display.

3.1.2.1 Product Generation Modes. The ITWS PG shall have an Product Generation Operational Mode and a Product Generation Maintenance Mode.

3.1.2.1.1 Product Generation Operational Mode. When in Product Generation Operational Mode, the ITWS PG shall produce real-time products from real-time inputs.

3.1.2.1.2 Product Generation Maintenance Mode. The ITWS PG shall be in Product Generation Maintenance Mode when commanded at the MDT.

This mode shall be capable of performing the following activities:

a. Playback of Recorded Input Data (Section 3.1.3.5.5);

b. Installation of new Software versions;

c. Installation and checkout of site adaptation changes, including the addition or deletion of external and internal interfaces; and

d. Diagnosing failed Line Replaceable Units (LRUs) and other system required maintenance activities.

3.1.2.2 Product Display Modes. The ITWS shall have Product Display Operational Modes that are associated with the source driving the individual airport display features on the SD, and a Product Display Maintenance Mode.

3.1.2.2.1 Product Display Modes. Depending on the connectivity between a given SD and the backup data sources (TDWR and LLWAS III) that are associated with a given ITWS site, the SD shall support one, two, or three (3) product display operational modes (ITWS, TDWR, and LLWAS) and a Product Display Maintenance Mode. The product display operational modes shall be separate for each airport served. Product display connectivity requirements shall be as derived from Section J of contract number DTFA01-97-C-00006 and the following:

a. The Product Display ITWS, TDWR and LLWAS Operational Modes shall be available at the ATCT SD and its associated RBDTs.

b. The Product Display ITWS and TDWR Operational Modes shall be available at the TRACON SD and its associated RBDTs.

c. The Product Display ITWS Operational Mode shall be available at the ARTCC SD.

The modes for each SD and its associated RBDTs shall be independent of the modes for the other SDs and their associated RBDTs. In all product display modes, the SD shall acquire, as operationally configured, ITWS, TDWR and LLWAS products if the products are operationally available from these systems.

3.1.2.2.2 Product Display ITWS Operational Mode. The Product Display ITWS Operational Mode shall be the normal (default) product display mode. In this mode, the SD and its associated RBDTs shall display ITWS products exclusively, with the exception of the conditions defined in Section 3.1.2.3.2.3.

3.1.2.2.3 Product Display TDWR Operational Mode. When operating in Product Display TDWR Operational Mode, the SDs shall acquire the products directly from the TDWR. The SDs and associated RBDTs shall display the TDWR products (i.e., including LLWAS data) exclusively, with the exception of the condition defined in Section 3.1.2.3.2.3.

3.1.2.2.4 Product Display LLWAS Operational Mode. When operating in Product Display LLWAS Operational Mode, the SDs shall acquire the products directly from the LLWAS. The RBDTs shall display LLWAS products exclusively.

3.1.2.2.5 Product Display Maintenance Mode. The ITWS SD shall transition to Product Display Maintenance Mode when commanded at the SD. This mode shall be capable of performing the following activities:

a. Reserved;

b. Installation of new Software versions;

c. Installation and checkout of site adaptation changes, including the addition or deletion of external and internal interfaces; and

d. Diagnosing failed LRUs and other system required maintenance activities.

3.1.2.3 Mode Priorities and Transition. Sections 3.1.2.3.1 through 3.1.2.3.2.2 and section 3.1.2.3.2.4 describe automatic transitions of SD Product Display Operational Modes based on the failure of a display mode, failure of a display mode source communications path, the SD having no displayable products available that meet the criteria for display, or the recovery from any of these conditions. When a product display has been manually selected for an individual airport display, automatic transition as described in sections 3.1.2.3.1 through 3.1.2.3.2.2 and section 3.1.2.3.2.4 shall be overridden.

3.1.2.3.1 Product Display Operational Modes. The priority level (from highest to lowest) of the product display operational modes shall be as follows:

a. Product Display ITWS Operational Mode,

b. Product Display TDWR Operational Mode, and

c. Product Display LLWAS Operational Mode.

3.1.2.3.2 Automatic Product Display Operational Mode Transition

3.1.2.3.2.1 Source Failure. If automatic mode transition is enabled and a SD product display operational mode has not been manually selected, each SD and its associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) shall automatically transition to the highest available product display operational mode, if one of the following events has occurred:

a. the source driving the SD has transitioned into maintenance mode (e.g., ITWS in Product Generation Maintenance Mode, or TDWR in Maintenance Mode),

b. the communication from the source driving the SD has failed, or

c. the SD receives no operationally usable display products from the source. The operational usability of products is determined by a combination of product status information and the timeliness of products.

If all sources for the SD product display operational modes have failed, the SD airport displays shall remain in the product display operational modes they were in prior to the last operational mode failure. The SD in the ARTCC shall remain in the Product Display ITWS Operational Mode if the ITWS PG has transitioned into the Product Generation Maintenance Mode or if communications from the ITWS PG has failed.

Table 1. Reserved.
Table 2. Reserved.
Table 3. Reserved.

3.1.2.3.2.2 Higher Priority Operational Mode Available. If a Product Display mode has not been manually selected, each SD and its associated RBDTs shall automatically transition to the highest priority operationally available Product Display Operational Mode if a higher Product Display Operational Mode has become available.

3.1.2.3.2.3 RBDT Product Data Sources. The SD supplies RBDT products to the RBDTs from ITWS, TDWR, or LLWAS sources in that order of priority. These product sources are associated with the SD product display ITWS, TDWR, or LLWAS operational modes respectively. When the data source associated with the current SD product display operational mode is unable to provide RBDT products, the SD shall provide data to the RBDTs from a lower priority data source. If the TRACON or ATCT SD is unable to provide the RBDT products from the ITWS PG to the RBDTs, the SD shall provide the RBDT products to the RBDT using the RBDT product data acquired by the SD from the TDWR RPG. If the ATCT SD is unable to provide the RBDT products to the RBDTs from the ITWS PG or the TDWR RPG, the SD shall provide the RBDT products

to the RBDT using the RBDT product data acquired by the SD from LLWAS.

3.1.2.3.2.4 Automatic Transition Response Time. Upon source failure (as defined in Section 3.1.2.3.2.1), the SD shall transition to the Product Display Operational mode defined in Section 3.1.2.3.1, and display the appropriate products in less than or equal to three (3) seconds.

3.1.2.3.2.5 Not Used.

3.1.2.3.3 Manual Mode Transition. The ITWS shall have the capability to manually select each of the ITWS System Modes as follows:

a. product generation modes from the MDT and

b. product display modes from the SD.

The SD shall manually transition to the selected product display mode in less than or equal to three (3) seconds.

3.1.3 Functional Requirements

3.1.3.1 Data and Product Acquisition. The ITWS will acquire weather data and products from sources as described in the following sections and the applicable interface documents. In some cases the source of data is via a direct interface to the originating system. In others, the data may be received indirectly through an intermediate source. The boundaries of the TRACON areas (as referred to below) are provided as GFE.

3.1.3.1.1 NEXRAD Acquisition. The ITWS shall acquire weather radar products from associated Next-Generation Weather Radar (NEXRAD) systems listed in Section J of contract number DTFA01-97-C-00006.

3.1.3.1.2 TDWR Acquisition. The ITWS shall acquire products and data from associated TDWRs listed in Section J of contract number DTFA01-97-C-00006.

3.1.3.1.3 LLWAS III Acquisition. The ITWS shall acquire products from associated LLWAS IIIs listed in Section J of contract number DTFA01-97-C-00006.

3.1.3.1.4 ASR-9 Weather Channel Acquisition. The ITWS shall acquire digitized weather radar data from associated ASR-9s listed in Section J of contract number DTFA01-97-C-00006.

3.1.3.1.5 AWOS/ASOS Acquisition. The ITWS shall acquire weather observation data via ADAS from all AWOS/ASOSs located within the area bounded by 30 miles beyond each associated ITWS

TRACON area. The list of locations of all AWOS/ASOS within the United States is provided as GFE.

3.1.3.1.6 Lightning Data Acquisition. The ITWS shall acquire lightning detection data via the ADAS.

3.1.3.1.7 NWS RUC Data Acquisition. The ITWS NFU located in the FAA ATCSCC shall acquire RUC data from the National Centers for Environmental Prediction (NCEP) via the FBWTG. The NFU shall provide filtered RUC data to each ITWS via the IP Network. The NFU shall be a stand-alone unit, and it shall report status to its associated ITWS PG directly. The NFU processing time for RUC data shall be less than two (2) minutes. Section J of contract number DTFA01-97-C-00006 describes the characteristics of RUC data.

3.1.3.1.8 MDCRS Acquisition. The ITWS shall acquire aircraft automated weather data from the FBWTG via the ITWS NFU. The filtered data, covering 30 miles beyond each associated ITWS TRACON area, shall be distributed to each ITWS PG via the IP Network. The MDCRS data shall have a higher priority than the RUC data for filtering and transmission. The NFU processing time for the MDCRS data shall be less than 30 seconds. Section J of contract number DTFA01-97-C-00006 describes the characteristics of MDCRS data.

3.1.3.1.9 User Input Data Acquisition. The ITWS PG shall accept input entered by ATCT/TRACON users via the SD to generate the Microburst Alert and Wind Shear Alert Automatic Terminal Information Service (ATIS) Timer Products (i.e., Table 4 Items 1.d.(1) and 1.d.(2)), and the Runway Configuration product (i.e., Table 4 Item 12).

3.1.3.1.10 ASR-11 Weather Data Acquisition. The ITWS shall acquire digitized weather radar data from associated ASR-11s listed in Section J of contract number DTFA01-97-C-00006.

3.1.3.2 Product Generation. The ITWS shall generate the weather products in Table 4 in accordance with (IAW) the algorithm description contained in DOT/FAA/ND-95/11. For locations where the SD and PG units are co-located (i.e., physically located in the same facility), the time duration to carry out the combined functions of product generation, communication, and product display for each product shall be less than the maximum allowable latencies defined in Table 4. For locations where the SD and PG units are not co-located, combined function latencies shall correspond to that for co-located units, excluding the time duration required for communications between the units. Product latency is measured from the time of the applicable event (i.e., receipt of data by the ITWS, or clock event), to the time of display or availability for product dissemination,

as defined by Table 4. For products that are displayed only upon operator action, latency excludes the time required for the operator to take, and for the system to recognize, the action. The maximum allowable latencies defined in Table 4 excludes the start-up time associated with any particular product (i.e., time associated with the initialization of an algorithm, to the point where it can produce its first output).

Table 4. ITWS Products and Latency Times

Item	Product	Nominal Update Interval	Update Basis	Maximum Allowable Latency	Beginning of Latency Period
1.	**Wind Shear**				
	a. Microburst Detection/Prediction				
	Detection Component	1 min*	TDWR microburst surface scan**	15 sec	End of TDWR microburst surface scan received**
	Prediction Component	2.5 min*	TDWR volume sweep	30 sec	End of highest elevation scan in TDWR volume sweep received**
	b. Gust Front Detection and Forecast				
	Initial Detection and Forecast	5 min*	TDWR volume scan	5 min	End of second Gust Front 360° in TDWR volume scan received**
	Position updates based on forecast	1 min	Clock	15 sec	Clock
	c. Ribbon Display Alerts				
	Phase III LLWAS Component	9 sec, if < or = 15 sensors * 14 sec, if > 15 sensors *	LLWAS	15 sec	LLWAS data received
	Microburst Component	(Same as 1a.)		(Same as 1a.)	
	Gust Front Component	(Same as 1b.)		(Same as 1b.)	

Item	Product	Nominal Update Interval	Update Basis	Maximum Allowable Latency	Beginning of Latency Period
1. (cont.)	d. Timers				
	(1) Microburst Alert Automatic Terminal Information Service (ATIS)	1 min	Clock	5 sec	Ribbon Display Alert or user input
	(2) Wind Shear Alert ATIS	1 min	Clock	5 sec	Ribbon Display Alert or user input
	(3) Gust Front Impact	1 min	Clock	5 sec	Gust Front position update
2.	**Gust Front Windshift Estimate**				
	a. Initial Windshift Estimate	5 min*	TDWR volume scan	5 min	End of second Gust Front 360° in TDWR volume scan received**
	b. Position updates based on forecast	1 min	Clock	15 sec	Clock
3.	**Precipitation**				
	a. 5 nm Range	1 min*	TDWR Precip. scan**	1 min	End of TDWR Precip. scan received**
	b. TRACON Range	30 sec*	ASR	30 sec	Newest ASR weather product received
	c. 100 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
	d. 200 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
4.	**Storm Motion and Extrapolated Position**				
	a. 5 nm Range	1 min*	TDWR Precip. scan**	1 min	End of TDWR Precip. scan received**
	b. TRACON Range	1 min*	ASR	30 sec	Newest ASR weather product received

Item	Product	Nominal Update Interval	Update Basis	Maximum Allowable Latency	Beginning of Latency Period
	c. 100 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
	d. 200 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
5.	**Storm Cell Information**				
	a. 5 nm Range	1 min*	TDWR Precip. scan**	1 min	End of TDWR Precip. scan received**
	b. TRACON Range	30 sec*	ASR	30 sec	Newest ASR weather product received
	c. 100 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
	d. 200 nm Range	5 min*	NEXRAD	1 min	NEXRAD product received
6.	**ASR Anomalous Propagation (AP)**				
	a. Precipitation with AP Flagged	30 sec*	ASR	30 sec	ASR weather product received
	b. AP Alert	30 sec*	ASR	30 sec	ASR weather product received
7.	**Tornado**				
	a. Detection	5 min*	NEXRAD	15 sec	NEXRAD product received
	b. Alert	5 min*	NEXRAD	15 sec	NEXRAD product received
8.	**Airport Lightning Warning**				
	Airport Lightning Warning	5 sec*	NLDN	15 sec	NLDN Data Received
9.	**LLWAS Winds or Airport Wind**				

Item	Product	Nominal Update Interval	Update Basis	Maximum Allowable Latency	Beginning of Latency Period
	LLWAS III	9 sec,if ? 15 sensors* 14 sec, if > 15 sensors*	LLWAS III	15 sec	LLWAS data received
	Airport Wind	10 sec*	ASOS via TDWR	15 sec	Airport Wind data received
10.	**Terminal Winds**				
	a. Gridded Wind Field	5 min	Clock	2 min until ready to disseminate	Clock
	b. Wind Profile	5 min	Clock	2 min	Clock
11.	**Terminal Weather Text Message**				
	a. Character Graphics	5 min	Clock	1 min until ready to disseminate	Clock
	b. Text	1 min	Clock	1 min	Clock
12.	**Runway Configuration**				
	Runway Configuration	n/a	n/a	10 sec until distributed to all displays	Time of operator entry
13.	**Terminal Convective Weather Forecast (TCWF)**				
	Terminal Convective Weather Forecast (TCWF)	5 min	Clock	5 min	Clock

*****Time is nominal because actual update is triggered by an external sensor.

** Determined by monitoring the TDWR Scan Strategy and the status of the TDWR Base Data Message contents shown in figure 3.2-2 of NAS-IC-31058603. The end of each elevation scan is

monitored by the EOE (end of elevation) bit. The Scan Strategy is site adaptable for each TDWR and is provided as GFI.

Note to Table 4: The nominal update intervals shown correspond to the fastest scanning modes of the TDWR and the NEXRAD. TDWR volume scans always take approximately five minutes, but volume sweep intervals vary from two and one-half (2.5) minutes to five (5) minutes; a volume sweep is a sampling of the coverage volume over a range of elevation angles from the lowest to the highest, and may occur multiple times per volume scan. The TDWR surface scan update interval varies from one (1) minute to five (5) minutes. The NEXRAD volume scan (i.e., and hence NEXRAD product) update rate varies from five (5) minutes to eleven minutes.

3.1.3.3 Display and CHI. The top level requirements for Display and CHI are described in this section. The detailed requirements for Display and CHI for the product display operational modes are contained in DOT/FAA/ND-95/10. The ITWS shall meet the requirements specified in DOT/FAA/ND-95/10.

3.1.3.3.1 SD

3.1.3.3.1.1 Product Display. The displayable products listed in Table 4 shall be displayed on the SD IAW DOT/FAA/ND-95/10.

3.1.3.3.1.2 Input Device. The SD shall accept operator command inputs from a three-button track-ball, a three-button mouse, or a keyboard. Only operator command inputs from either a three-button track-ball or a three-button mouse shall be accepted for the operator commands specified in DOT/FAA/ND-95/10, unless otherwise specified.

3.1.3.3.1.3 Start-up Characteristics. The SD shall require no more than one (1) action for power turn on to the Product Display ITWS Operational Mode. If that mode is not available, the ITWS shall automatically initialize to the next available lower priority mode as specified in Section 3.1.2.3.1.

3.1.3.3.1.4 Display Configurability. The organization of information on the display shall be configurable as specified in DOT/FAA/ND-95/10.

3.1.3.3.1.5 Mode Indication. The SD shall indicate the Product Generation Mode and the Product Display Operational Mode as specified in DOT/FAA/ND-95/10. The SD shall indicate the status of each associated TDWR as specified in DOT/FAA/ND-95/10.

3.1.3.3.1.6 Print Capability. The SD will provide printer output to an ITWS network printer. The ITWS network printer shall provide high-resolution color output for all local SDs.

3.1.3.3.1.6.1 SD Processing. Upon operator command entry from the SD, the ITWS shall generate the printer output required to produce a hard copy color image of the currently displayed SD color image. The SD shall be capable of directing the captured image to the ITWS network printer when the printer is available to the SD. The hard copy of the displayed SD color image shall contain the data date/time or elapsed time.

3.1.3.3.1.6.2 COTS Printer Output Characteristics. The COTS characteristics of the ITWS network printer shall be as follows:

a. Color print resolution no less than 600 x 600 dots per inch;
b. Output rate no less than 4 color pages per minute;
c. Postscript 3 Format.

3.1.3.3.1.7 Commands for Product Display Operational Mode. In the Product Display Operational Modes, the SD shall execute operator commands specified in DOT/FAA/ND-95/10. These commands include selecting product display options and display products, choosing background maps, setting the countdown timer, and printing a display image. With the exception of editing runway configurations, the Display Support Commands (Section 3.1.3.3.6.1) are not specified in DOT/FAA/ND-95/10.

3.1.3.3.1.7.1 Command Response Time. For the operator commands, the response time from completion of command entry until the results of that command are displayed shall be IAW DOT/FAA/ND-95/10.

3.1.3.3.1.7.2 Command Availability. Operator commands which are password-protected and operator commands available to the user according to the SD configuration shall meet the requirements specified in DOT/FAA/ND-95/10.

3.1.3.3.1.8 Time Display. The SD shall display time as follows:

a. current date and time during ITWS Product Display operational modes;
b. actual event date and time during playback of SD archive data or PG recorded input data; and
c. elapsed time from the beginning of the scenario during certification test scenarios.

3.1.3.3.2 Ribbon Display

3.1.3.3.2.1 Product Display. Specific products listed in Table 4 shall be displayed on the RBDT IAW DOT/FAA/ND-95/10.

3.1.3.3.2.2 Audible Alarms. The Ribbon Display audible alarm shall meet the requirements specified in DOT/FAA/ND-95/10.

3.1.3.3.2.3 Display Blanking Conditions. The RBDT screen shall be blanked and an equipment status message displayed when all RBDT sources are non-operational due to a failure.

3.1.3.3.3 Product Display TDWR Operational Mode. When the SD and associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) are operating in Product Display TDWR Operational Mode, the SD and/or associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) shall perform the following functions:

a. The SD shall acquire data directly from the TDWR (RPG). The SD shall meet the requirements specified in the TDWR to ITWS IRD Part 2, NAS-IR-31052514. The SD processing time shall be less than or equal to the SD processing time when products are acquired directly from the PG.

b. The SD and associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) shall display TDWR products (i.e., including LLWAS data) as specified in DOT/FAA/ND-95/10.

3.1.3.3.4 Product Display LLWAS Operational Mode. When the SD and associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) are operating in Product Display LLWAS Operational Mode, the SD and/or associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) shall perform the following functions:

a. The SD, in the same manner as the TDWR Display Functional Unit (DFU), shall acquire data directly from LLWAS III IAW:

    1) The SDs in the ATCT shall have the capability to accept and display products from the LLWAS III whenever TDWR is in maintenance mode or TDWR alphanumeric/graphic data is unavailable. The SD processing time shall be less than or equal to the SD processing time when products are acquired directly from the PG.

    2) The LLWAS III to DFU interface defined in the TDWR/LLWAS Interface Control Document (ICD) Build 5, NAS-IC-31053102.

b. The SD and associated RBDTs (with the exception of the conditions defined in Section 3.1.2.3.2.3) shall display LLWAS III acquired data IAW DOT/FAA/ND-95/10.

3.1.3.3.5 Product Display Maintenance Mode. In Product Display Maintenance Mode, the SD shall indicate that it is in the Product Display Maintenance Mode.

3.1.3.3.6 Display Support Function. Each ITWS shall provide a display support function that allows the user to enter display support commands at the SDs and MDT. If the execution of a display support command will cause a change in the Product Display Mode, ITWS shall request confirmation from the user that it is acceptable to change modes prior to the mode switch. ITWS shall require the entry of a password to permit a user at the SD to gain access to the display support commands. ITWS shall require the entry of a password (Section 3.1.3.5.6) to permit a user at the MDT to gain access to the display support commands. ITWS shall accept entry of multiple display support commands without requiring the re-entry of the display support password. The access by an SD to sets of display support commands shall be determined by adaptation parameters.

3.1.3.3.6.1 Display Support Commands. The ITWS will provide the following display support commands.

a. Reserved.

b. Reserved.

c. Change Password. Upon execution of the command from the SD or MDT, users shall be able to change their password. This command shall apply globally to all associated SDs and the MDT.

d. Reserved.

e. Set Runway Control. Upon execution of the command from the SD or MDT, users shall be able to allow or disallow the availability of a runway to be included in any runway configuration on the SD. This command shall apply globally to all associated SDs.

f. Edit Alarm Timeout. Upon execution of the command from the SD or MDT, users shall be able to edit the RBDT default values for the following:

(1) Alphanumeric Alarm Period as specified in DOT/FAA/ND-95/10;

(2) Blanking Alarm Period (i.e., valid range 5-300 seconds (sec); default is 5 sec); and

(3) Watchdog Timer Interval (i.e., valid range 18.25 sec-77.8 minutes (min); default is 54.75 sec).

The Edit Alarm Timeout command shall apply globally to all associated SDs.

g. Edit Runway Configurations. Upon execution of this command from the SD or MDT, users shall be able to edit the runway configuration information as specified in DOT/FAA/ND-95/10.

h. Archive Retrieval. Upon execution of this command from the SD, users shall be able to playback archived products as specified in Section 3.1.3.5.2.

i. Transfer of Archive Data To Removable Media. Upon execution of this command from the SD, users shall be able to copy a portion of the product archive to removable media. The use of this command at a given SD shall be independent from other SDs.

j. Transfer of Archive Data From Removable Media. Upon execution of this command from the SD, users shall be able to retrieve a portion of the product archive from removable media and copy it to disk. The use of this command at a given SD shall be independent from all other SDs.

3.1.3.3.6.2 Display Support Response Indication. The SD shall display an indication of command execution for display support commands whose response time from completion of command entry to displayed results is equal to or greater than three (3) seconds.

3.1.3.4 Product Dissemination. The ITWS will disseminate weather products to external systems IAW the applicable interface documents and as described in the following subsections.

3.1.3.4.1 External User Products. The ITWS will generate 2 types of product sets, each consisting of a defined number of products from Table 4. Each user will be provided one product set. The ITWS shall provide product sets to external users, as specified by site adaptable addresses.

3.1.3.4.1.1 External User One. The external user one product set shall contain all ITWS products. The ITWS will provide external user one products only from the ITWS PG (router) directly. The ITWS shall provide output and connectivity for one external user one.

3.1.3.4.1.2 External User Two. The external user two product set shall contain only products which may be displayed (Table 4, Products 1-9, 10b, 11b, and 12-13). The ITWS will provide external user two products locally from the ITWS PG router directly, and remotely to the Volpe National Transportation System Center (Volpe) server. Connectivity of those users to Volpe is not covered by this specification. The ITWS shall be

capable of providing output and connectivity for 3 simultaneous external users two, including Volpe.

3.1.3.4.1.3 Protocols.

a. Data transmission between the PG and the user (including Volpe) shall be: 1) in accordance with RFC-793 (TCP); and 2) in accordance with RFC-791(IP).

b. Data transmission between the PG router and the local (intra-facility) user shall be via Ethernet as specified in RFC-894 and IEEE 802.3.

c. Data transmission between the PG router and other local (direct connection) users shall be as specified in RFC-1661 and RFC-1662 (Point-to-Point protocol (PPP)). The electrical, mechanical, and signaling characteristics of the PG router interface to the local LINCS node shall be IAW EIA-530A.

d. Data transmission between the PG router and the GFE IP Network router (supporting Volpe) shall be via Ethernet as specified in RFC-894 and IEEE 802.3.

e. For PG locations where there is no GFE IP network router, data transmission between the PG router and the remote (ARTCC) GFE IP network router (via LINCS) shall be as specified in RFC-1661 and RFC-1662. The electrical, mechanical, and signaling characteristics of the PG router interface to the local LINCS node shall be IAW EIA-530A.

3.1.3.4.2 Data Link User. The ITWS shall disseminate Terminal Weather Text Messages (Table 4, Products 11a and 11b), as specified by site adaptable addresses, to the Data Link User via NADIN-II PSN.

3.1.3.5 System Control and Support.

3.1.3.5.1 Product Archiving. In all product display operational modes, ITWS shall store, without user intervention, 15 days of the data required to recreate the weather products which could have been presented on a SD, and the products which were displayed on each of the RBDTs. The archive data shall include, but is not limited to, displayable products on the SD and RBDT, displayable data, system status messages, and field-settable adaptation parameters. All archive data shall be tagged with Julian date; and Universal Coordinated Time (UTC) hour, minute, and second of generation. ITWS shall retain archive data during power loss and maintenance activities.

3.1.3.5.2 Playback of Archived Products. The ITWS shall be capable of displaying any archived data on the SD and RBDT.

Playback shall be controllable from the SD. Playback at a given SD shall be independent from other SDs. The playback capability shall allow the print command (Section 3.1.3.3.1.7), and operator commands specified in DOT/FAA/ND-95/10 entered from the SD, to exercise all SD options throughout the playback. Playback shall be performed without changing the Product Generation mode.

3.1.3.5.3 Input Data Recording. The ITWS shall continuously store on line the latest six (6) hours of all data and products acquired, IAW Section 3.1.3.1 and subsections, without user prompting. All recorded data shall be tagged with the UTC date and time (to the second) of acquisition.

3.1.3.5.4 Recorded Input Data Transfer. The ITWS shall provide the capability to transfer recorded input data to a transportable electronic storage medium, in response to a command from the MDT. This shall be accomplished without changing the product generation mode. The MDT shall provide a continuous display indication of the completion percentage (e.g., 10%, 50%) of the transfer operation.

3.1.3.5.5 Playback of Recorded Input Data. The ITWS shall be capable of performing all product generation using as input the data and products recorded as specified in Section 3.1.3.5.3. This processing shall be controllable from the MDT, and shall be possible only during Product Generation Maintenance Mode. Playback of recorded input data shall be capable of supporting both an on-line storage device and a transportable storage medium.

3.1.3.5.6 Access to the System. The ITWS shall prevent unauthorized access by external users. The ITWS shall have three (3) levels of access via the MDT and SD, as follows:

a. the supervisory level,

b. the maintenance level, and

c. the display support level.

3.1.3.5.6.1 Supervisory Level Access. The supervisory level password shall allow access to the maintenance/system control functions. Supervisory level access shall provide the capability to modify all passwords.

3.1.3.5.6.2 Maintenance Level Access. The maintenance level password shall only allow access to the maintenance/system control functions, including the RMS/NIMS interface functions. The ITWS shall be capable of allowing individual access based on unique user name and associated unique individual passwords.

3.1.3.5.6.3 Display Support Level Access. The display support level access is specified in Section 3.1.3.3.6.

3.1.3.5.6.4 Password Characteristics. The ITWS shall use a minimum of eight characters for each password. The passwords shall be case sensitive. Stored passwords shall be secured using encryption provided by the operating system.

3.1.3.5.6.5 Security Banner.

3.1.3.5.6.5.1 Display Devices. The ITWS shall display the ITWS banner at the ITWS display device in conjunction with the log-on process.

3.1.3.5.6.5.2 Banner Characteristics. The ITWS shall display the banner using at least 14-pitch font. The banner shall remain displayed for at least 30 seconds or until action is taken by the display user.

3.1.3.5.6.5.3 Banner content. The ITWS banner shall contain the following content:

****WARNING**WARNING**WARNING****

This is a Federal Aviation Administration (FAA) computer system. FAA systems, including all related equipment, networks, and network devices (specifically including Internet access) are provided for the processing of official U.S. Government information. Unauthorized access or use of this computer system may subject violators to criminal, civil, and/or administrative action.

All information on this computer system may be intercepted, recorded, read, copied, and disclosed by and to authorized personnel for official purposes, including criminal investigations. Access or use of this computer system by any person, whether authorized or unauthorized, constitutes consent to these terms.

****WARNING**WARNING**WARNING****

3.1.3.5.7 Logging of System Operations. The ITWS shall continuously generate and maintain a log of the latest 24 hours of the following system events except for access logging events (a and g below) which shall be maintained for the latest 15 days:

a. MDT and SD log-on, log-off, and all unsuccessful log-on attempts with three or more times in 15 minutes;

b. System state and mode changes;

c. Hardware, software, and communications errors detected;

d. Hourly summary of average, minimum, and maximum resource utilization (i.e., Central Processing Unit (CPU), memory, and storage);

e. Problems with the timeliness of products (as determined by products exceeding latencies or expiration times) ;

f. Changes to field settable adaptation;

g. Log-on and log-off to the operating system.

3.1.3.5.7.1 Log Contents. For each event, the log shall contain the UTC date and time (to the second) of occurrence and the identification of the originator.

3.1.3.5.7.2 Hard Copy of System Log. The ITWS shall write a copy of the system log to the MDT printer port upon command entered at the MDT.

3.1.3.5.7.3 Display of System Log. The ITWS shall display the system log at the MDT upon operator request. The ITWS shall provide the option of displaying the log as it is updated or in static form. This shall be accomplished without changing product generation mode.

3.1.3.5.7.4 Log Storage. The ITWS shall maintain the log on the hard drive. The log shall not be purged if the power fails or if the operating system or application software crashes.

3.1.3.5.8 System Time

3.1.3.5.8.1 UTC Acquisition. The ITWS shall extract UTC from the TDWR Base Data.

3.1.3.5.8.2 System Time Synchronization. The ITWS shall synchronize its system time with the UTC received from the TDWR.

3.1.3.5.8.3 System Time Accuracy. The ITWS shall maintain system time accurate to within one (1) second of the received TDWR UTC.

3.1.3.5.8.4 Manual Set Time Command. The ITWS shall have the capability to allow operator entry of the date and time via the MDT.

3.1.3.5.9 Site Adaptation. The ITWS shall have the capability to display and modify field-settable adaptation data at the MDT and/or SD, including at least those which are shown in Table 5.

ITWS shall have the capability to display and modify user-settable adaptation data at the SD. The ITWS shall have the capability to display and print sets of adaptation data at the MDT. The ITWS shall be capable of saving and restoring both the default and the most recent field settable adaptation data input by the user.

Table 5. Field Settable Adaptation Data

Item	MDT	SD
Entry deleted		
NEXRAD choice(s)	Yes	No
TDWR choice(s)	Yes	No
ASRchoice(s)	Yes	No
External User Port Products	Yes	No
ITWS NFU Monitoring	Yes	No
Access to Display Support Commands	**MDT**	**SD**
a. Entry deleted		
b. Entry deleted		
c. change password	Yes	Yes
d. Entry deleted		
e. set runway control	Yes	Yes
f. edit alarm timeout	Yes	Yes
g. edit runway configurations	Yes	Yes
h. archive retrieval	No	Yes
i. transfer of archive data to removable media	No	Yes
j. transfer of archive data from removable media	No	Yes

3.1.3.5.10 RMS Function. The ITWS shall provide RMS functions as specified in NAS-MD-793A, Sections 3.1.1.1 through 3.10.1 except Sections 3.1.1.1.d, 3.1.1.2, 3.1.2.1.f, 3.1.2.1.g, 3.1.2.1.h, 3.1.3.2.d, 3.2.2.d, 3.2.2.2, 3.2.2.3, 3.2.3.1, 3.2.3.2, 3.3.2, 3.3.3, 3.3.4, 3.3.5.a, 3.3.5.b, 3.4, 3.5, 3.8.3, 3.9.4, 3.10.1.b, and 3.10.1.c. Additionally, in Tables 3-I, 3-II, and 3-III, the tabular entry under the column heading “RMS Control Mode Definition” related to the RMS Control Mode of “Remote” is modified to “remote control, local and remote reporting.” In Table 3-I, the entry under the column heading “Report Maintenance status Notifications to:” related to the RMS Control Mode of “Remote” is modified to “MPS and local MDT.” In Table 3-II, the entry under the column heading “Accept

Maintenance Data Requests from:" related to the RMS Control mode of "Remote" is modified to "MPS and local MDT." In Table 3-III, the entry under the column heading "Accept Maintenance Control Commands from:" related to the RMS Control Mode of "Remote" is modified to "MPS and local MDT." In Table 3-III, the entry under the column heading "Report Maintenance Control responses and Secondary Responses (Maintenance Data Reports) to:" is modified to "MPS and local MDT."

3.1.3.5.11 Reserved.

3.1.3.5.12 SD and Associated RBDT Status Reporting.

Table 6. Reserved.

3.1.3.5.12.1 Status for PG Available Condition. To avoid duplicate reporting of SD and RBDT failures to the RMMS by both ITWS and TDWR, the SD shall report to the TDWR a status of "operational" for the SD and RBDT equipment and communication links, whenever the PG is available and operating correctly with the MPS.

3.1.3.5.12.2 Status for PG Not Available Condition. The SD shall report the status of the SD and its associated RBDTs to TDWR whenever the PG is unavailable or the PG/MPS interface is inoperative.

3.1.3.5.13 Reserved.

3.1.3.5.14 Off-Line Storage of System Software. The ITWS software shall be recoverable from a transportable secondary storage device in the event that a system restart or cold start is necessary and software errors are detected.

3.1.4 System Functional Relationships. The relationship between the functions of the ITWS (as specified in Section 3.1.3) are as depicted in Figure 2.

3.1.4.1 Data Verification. ITWS shall perform error-detection, and correction or re-transmission, on data transmitted over physical interfaces between the Product Generation and Display and CHI functions, excluding the RBDT. An error is defined as the occurrence of incorrect format or content of the transmitted data.

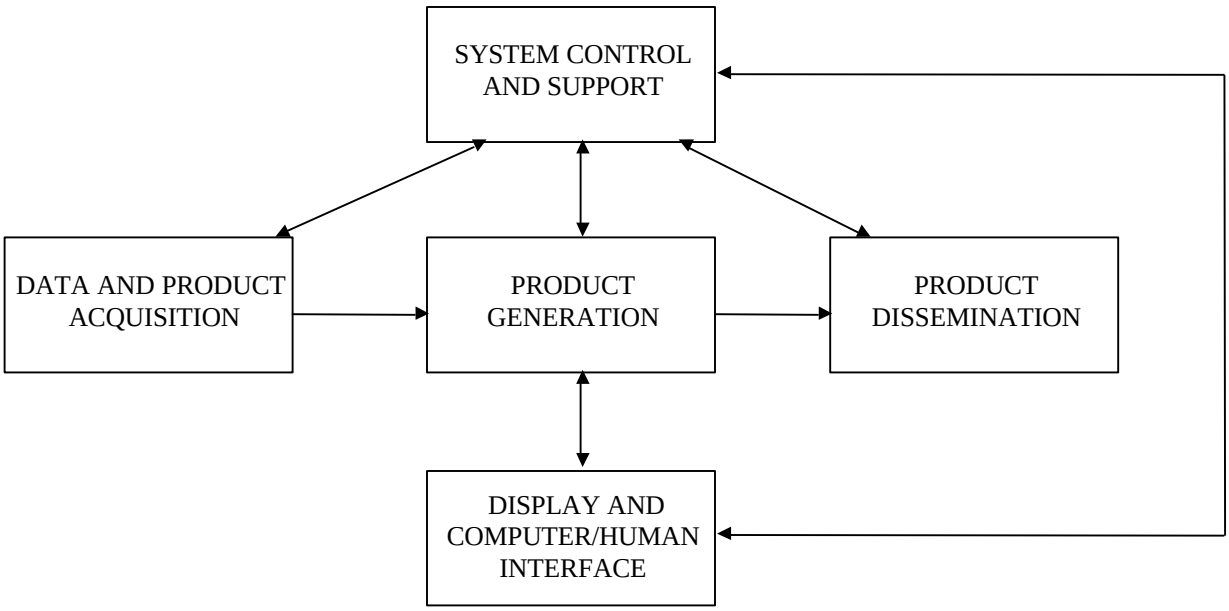

Figure 2. ITWS Functional Relationships

3.1.4.2 Relationship between SD and ITWS Functions. The following ITWS functions will be performed outside of the SD component:

a. Data and Product Acquisition (Section 3.1.3.1), including TDWR Base Data Acquisition (Section 3.1.3.1.2); but excluding TDWR and LLWAS Product Acquisition (Sections 3.1.3.1.2 and 3.1.3.1.3) supporting TDWR or LLWAS operational modes, and User Input Data Acquisition (Section 3.1.3.1.9);

b. Product Generation (Section 3.1.3.2); and

c. Product Dissemination (Section 3.1.3.4).

3.1.5 Reserved.

3.1.6 Interface Requirements

3.1.6.1 Internal Interfaces. The PG shall have the capability to support multiple SDs located in ATCTs, TRACONs, and ARTCCs, IAW Section J of contract number DTFA01-97-C-00006. Each SD shall have the capability to simultaneously process and display data from one (1) or more PGs, IAW Section J of contract number DTFA01-97-C-00006. Each SD shall have the capability to support a maximum of eight (8) RBDTs.

3.1.6.1.1 MDT. The ITWS shall interface with the MDT IAW NAS-MD-793A, Sections 3.1.1.1 through 3.10.1 except Sections 3.1.1.2, 3.2.2.2, 3.2.2.3, 3.2.3.1, 3.2.3.2, 3.3.2, 3.3.3, 3.3.4, 3.3.5.a, 3.3.5.b, 3.4, 3.5, 3.8.3, 3.9.4, 3.10.1.b, and 3.10.1.c. The ITWS shall provide a dedicated ethernet port for interfacing with the MDT. The MDT will consist of a laptop personal computer.

3.1.6.1.2 SD Communications. The ITWS PG will interface with the ITWS SD as follows:

a. Data transmission between the PG and SD shall be in accordance with RFC-793 (TCP). Data transmission between the PG and the SD shall be in accordance with RFC-791(IP).

b. For the local SD configuration, data transmission between the PG and SD shall be via Ethernet as specified in RFC-894 and IEEE 802.3.

c. For the remote SD configuration, data transmission shall be via the Ethernet from the PG router to the local GFE IP Network router as specified in RFC-894 and IEEE 802.3.

d. For the remote SD configuration, data transmission between the SD router and the remote (TRACON) GFE IP network router (via LINCS) shall be as specified in RFC-1661 and RFC-1662.

e. For the remote SD configuration, the electrical, mechanical, and signaling characteristics of the interface to the local LINCS node shall be IAW EIA-530A.

3.1.6.1.3 Interface to RBDT. The SD shall interface to the RBDT IAW APD-250M045/APD-250M060, Plasma Display Monitor/Alarm System Instruction Manual.

3.1.6.1.4 Archive Data Recorder. The ITWS shall have a 2-way interface for recording and playback with the Archive Data Recorder using a Small Computer Systems Interface (SCSI)-II-type interface, or another interface as approved by the Government Contracting Officer.

3.1.6.1.5 Input Data Recorder. The ITWS shall interface with the Input Data Recorder using a SCSI-II-type interface, or another interface as accepted by the Government Contracting Officer.

3.1.6.1.6 Input Data Port. The ITWS shall provide one (1) input data port in the same format and configuration as the Input Data Recorder.

3.1.6.1.7 ITWS NWS Filter Unit (NFU). Each ITWS shall interface with the ITWS NWS Filter Unit (NFU).

a. Data transmission between the PG and NFU shall be in accordance with RFC-793 (TCP). Data transmission between the PG and the NFU shall be in accordance with RFC-791 (IP).

b. Data transmission shall be via the Ethernet from the PG router to the local GFE IP Network router as specified in RFC-894 and IEEE 802.3.

c. For PG locations where there is no GFE IP network router, data transmission between the PG router and the remote (ARTCC) GFE IP network router (via LINCS) shall be as specified in RFC-1661 and RFC-1662. The electrical, mechanical, and signaling characteristics of the interface to the GFE IP network shall be IAW EIA-530A.

d. Data transmission shall be via the Ethernet from the NFU to the local GFE IP Network router as specified in RFC-894 and IEEE 802.3.

3.1.6.1.8 Network Printer. The SD shall interface to the Network Printer via the local ethernet connection as specified in RFC-894 and IEEE 802.3. The interface shall be in accordance with RFC-793 (*TCP)*. The interface shall be in accordance with RFC-791 (*IP).*

3.1.6.2 External Interfaces. The ITWS will interface with the following external systems to receive and disseminate data and products.

3.1.6.2.1 TDWR. The ITWS shall interface with the TDWR IAW NAS-IR-31052514 (Parts 1 and 2) except that in Part 2, Section 3.2.1.3.5 and Section 3.2.2.6 and its subsections do not apply to ITWS.

3.1.6.2.2 ADAS. The ITWS shall interface with the ADAS IAW NAS-IC-25082514 via NADIN-II PSN.

3.1.6.2.3 NEXRAD. The ITWS shall interface with the NEXRAD radar IAW Interface Control Document for RPG/Associated PUP (Document Number 2620001A).

3.1.6.2.4 ASR-9. The ITWS shall interface with the ASR-9 radar IAW NAS-IR-34032514.

3.1.6.2.5 ASR-11. The ITWS shall interface with the ASR-11 radar IAW NAS-IR-TBD.

3.1.6.2.6 Data Link User. The ITWS shall interface with the Data Link User IAW NAS-IC-TBD via NADIN-II PSN with the following exception:

a. ITWS will not send TDWR Product and Status messages or their equivalent over this interface.

3.1.6.2.7 NADIN-II PSN. The ITWS shall interface with the NADIN-II PSN IAW NAS-IC-43020001.

3.1.6.2.8 FBWTG. The ITWS NFU shall interface with the FBWTG IAW NAS-IR-94142514.

3.1.6.2.9 LLWAS. The ITWS SD shall interface with the LLWAS III IAW NAS-IC-31053102 with the following exceptions:

a. The point of demarcation for ITWS is the ITWS SD instead of the TDWR DFU.

b. The LLWAS II does not have an interface with the ITWS SD.

3.1.6.2.10 ARTCC SD. The ITWS PG shall interface with the ARTCC SD as follows:

a. Data transmission between the PG and SD shall be in accordance with RFC-793 (TCP). Data transmission between the PG and the SD shall be in accordance with RFC-791 (IP).

b. Data transmission shall be via the Ethernet from the PG router to the local GFE IP Network router as specified in RFC-894 and IEEE 802.3.

c. For PG locations where there is no GFE IP network router, data transmission between the PG router and the remote (ARTCC) GFE IP network router (via LINCS) shall be as specified in RFC-1661 and RFC-1662. The electrical, mechanical, and signaling characteristics of the interface to the GFE IP network shall be IAW EIA-530A.

d. Data transmission shall be via the Ethernet from the SD to the local GFE IP Network router as specified in RFC-894 and IEEE 802.3.

3.1.6.2.11 NIMS. The ITWS PG shall interface with NIMS in accordance with NAS-MD-790, SCN-1 except Sections 3.2.2.3, 3.4.4, 3.5.1, 3.5.4, 3.5.5, 3.7.2, 3.7.3, 3.7.4, 3.7.8, and 3.7.9. The demarcation point will be at the local PG facility.

3.2 System Characteristics

3.2.1 Physical Requirements

3.2.1.1 Weight Distribution. The weight of the ITWS equipment shall not exceed those values specified in Table 3-I of NAS-IR-63002514.

3.2.1.2 Dimensional Constraints. The physical dimensions of the ITWS equipment shall not exceed those values specified in Table 3-I of NAS-IR-63002514.

3.2.1.3 Maintenance Access. Equipment units shall provide front and rear access as needed for maintenance and repair activities. The distance required for front and rear maintenance access between the rows of equipment units shall be IAW NAS-IR-63002514.

3.2.1.4 Durability. The structural strength and rigidity of the equipment units shall be such that common carrier handling in loading, shipping, unloading, and setting into position for installation shall not cause damage to any ITWS component nor deformation to the equipment units.

3.2.1.5 Electrical Power Requirements. The electrical power requirements for the ATCT and TRACON equipment shall comply with NAS-IR-63002514, Section 3.2.2 and subsections. The electrical power requirements for the ARTCC equipment shall comply with NAS-IR-61002514, Section 3.2.2 and subsections. ITWS power distribution requirements shall be as described below.

a. Each equipment unit, except for the SD, shall be provided with a single circuit breaker for supply-power overload protection, as well as a visible circuit-breaker indicator. The circuit breaker shall comply with the requirements for electrical overload devices as outlined in FAA-G-2100, Section 3.3.1.3.2.1.

b. Each equipment unit shall provide for the distribution of electrical power within the unit.

c. Design of the ITWS shall be such that the removal of power from any component cannot damage any other component.

3.2.1.6 Electrical Power Loss

3.2.1.6.1 Electrical Power Loss of 30 Seconds or Less. The ITWS, including displays, shall not be affected by a power loss of 30 seconds or less when operating in an environment using essential power.

3.2.1.6.2 Electrical Power Loss of Greater than 30 Seconds. Displays shall restore themselves to the highest priority Product Display Operational Mode (defined in Section 3.1.2.2.1) available, with automatic mode selection enabled, no more than five (5) minutes after restoration of electrical power.

3.2.1.7 SD Requirements

3.2.1.7.1 Size. Unless specified otherwise in contract number DTFA01-97-C-00006, the viewing screen of the SD shall be as described below.

a. The ATCT SD shall be at least 18 inches measured diagonally.
b. The TRACON Operations Room and ARTCC SDs shall be at least 24 inches measured diagonally.

The outline dimensions of the SDs shall be as specified in NAS-IR-63002514 and NAS-IR-61002514.

3.2.1.7.2 Proximity of Input Device. All SD input devices (keyboard, track-ball, and mouse) shall be able to operate at a distance of at least five (5) feet from the SD monitor.

3.2.1.7.3 Brightness Control. The SD shall have a brightness control.

3.2.1.7.4 Contrast Control. The SD shall have a contrast control.

3.2.1.7.5 Color. The SD shall have a color palette IAW DOT/FAA/ND-95/10.

3.2.1.7.6 Character and Symbol Sizes. Character and Symbol sizes shall meet the requirements in DOT/FAA/ND-95/10.

3.2.1.7.7 Viewability. The SD viewing screen shall be visible, from the front without obstructions caused by the SD casing. The SD viewing screen shall be capable of being tilted 05 degrees (deg) forward and 15 deg backwards about the horizontal axis.

3.2.1.7.8 Display Technology. The SD shall use a non-interlaced display technology. The SD shall have a minimum refresh rate of 67 Hz.

3.2.1.7.9 Display Resolution. The minimum resolution of bit graphics display shall be 1280 (horizontal) by 1024 (vertical) pixels.

3.2.1.7.10 Luminance. When viewed perpendicular to the viewing screen, the luminance of the SD white screen shall be at least 230 candela/square meter in a dark ambient and in a 450 foot-candle ambient.

3.2.2 Environmental Conditions. The SD to be installed in the ATCT and the SDs and the PG to be installed in the TRACON shall comply with NAS-IR-63002514, Section 3.2.3 and subsections. The SDs to be installed in the ARTCC shall comply with NAS-IR-61002514, Section 3.2.3.

3.2.3 Materials, Processes, and Parts. "Internal interfaces" are defined as those interfaces between physical equipment within ITWS. ITWS parts and materials shall meet the following requirements without modification of any commercial off-the-shelf (COTS) physical equipment within ITWS:

a. FAA-G-2100, Section 3.3.1.1.3 Flammable Materials;

b. External and internal interfaces shall meet FAA-G-2100, Section 3.3.1.3.3 Electrical Connectors and subsections, excluding Subsection 3.3.1.3.3.2, and shall meet Section 3.3.5.1.12 Electrical Connectors;

c. FAA-G-2100, Section 3.3.1.3.6 Printed Wiring Board Modification;

d. Reserved;

e. Reserved;

f. Reserved;

g. External and internal interfaces shall meet FAA-G-2100, Section 3.3.1.3.10 Wiring and subsections excluding Subsections 3.3.1.3.10.1, 3.3.1.3.10.4, 3.3.1.3.10.16, 3.3.1.3.10.17a, 3.3.1.3.10.17b;

h. Section 3.3.1.3.10.20 Fiber Optics; and

i. Fastener hardware shall meet FAA-G-2100 Section 3.3.1.4.3 Fastener Hardware and subsections.

3.2.4 Electromagnetic Compatibility. The ITWS shall be implemented in compliance with FAA-G-2100, Section 3.3.2.

3.2.5 Workmanship. Workmanship shall be IAW MIL-HDBK-454.

3.2.6 Interchangeability. All ITWS equipment and parts supplied by the Contractor that are interchangeable or replaceable shall conform to FAA-G-2100, Section 3.3.4.

3.2.7 Personnel Safety and Health. All ITWS equipment shall be designed and constructed so that the potential for personal injury during installation, operation, and maintenance is minimized. The ITWS shall be designed IAW FAA-G-2100 Section 3.3.5 and subsections.

3.2.8 Human Engineering. All ITWS components shall meet the requirements of FAA-G-2100, Section 3.3.6 and subsections.

3.3 Processing

3.3.1 Not used.

3.3.1.1 Commercially Available Software (CAS). The use of commercially available software (CAS) is encouraged provided prior Government Contracting Officer's approval is granted.

3.3.1.2 Not Used.

3.3.1.3 Not Used.

3.3.1.4 Software Revisions. The ITWS shall have the capability to accept system software revisions from transportable electronic media.

3.3.2 Reserve Requirements. Each ITWS PG, NFU and SD processing resource shall meet the following reserves while ITWS is ingesting and processing, without performing load shedding, a Government furnished "worst case" weather scenario and meeting all requirements of this specification. The "worst case" scenario is provided in Section J of contract number DTFA01-97-C-00006. The ITWS shall monitor the CPU and memory reserve.

3.3.2.1 CPU Utilization. ITWS shall contain sufficient processing reserve capacity so that the mean utilization over any 5-minute interval does not exceed 75 percent of the maximum processing capacity.

3.3.2.2 Memory Utilization. ITWS shall contain sufficient memory reserve capacity so that memory utilization does not exceed 75 percent of the maximum memory capacity.

3.3.2.3 Storage Utilization. ITWS shall contain sufficient on-line storage reserve capacity so that the storage utilization within the ITWS system does not exceed 50 percent of the maximum on-line storage capacity.

3.3.3 Reserved.

3.4 Quality Factors.

3.4.1 Reliability. The ITWS shall be designed for the following conditions:

a. a minimum system Mean-Time-Between-Failure (MTBF) of at least 2704 hours for the following configurations: one (1) ITWS PG, one (1) ATCT and one (1) TRACON SD associated with each ITWS airport, and intra-TRACON communications.

b. a MTBF for the NFU of at least 10000 hours.

A failure is defined as a condition where the ITWS cannot meet requirements excluding the following:

a. Improper or incomplete operation of equipment and facilities external to ITWS;

b. Environmental stresses beyond those in Section 3.2.2;

c. RBDT operations;

d. Input data recording and playback functions.

3.4.2 Maintainability. Mean-Time-To-Repair (MTTR) for the ITWS shall not exceed 0.5 hours. This period includes all time necessary to localize, repair, test, and restore a failed system/unit to normal operating conditions.

3.4.2.1 Preventive Maintenance. The ITWS shall be designed so that no more than four (4) site visits per year to accomplish preventive maintenance are required.

3.4.2.2 Corrective Maintenance. The ITWS shall be designed so that no more than four (4) site visits per year to accomplish corrective maintenance are required.

3.4.2.3 Not Used.

3.4.3 Flexibility and Expansion. The system design shall provide for the expansion of the following items to at least two (2) times each site configuration:

a. main processor processing capacity, memory and storage for each PG, SD, and the NFU;
b. number of supportable SDs; and
c. number of PG input/output communications ports.

3.4.4 Availability. The ITWS shall have an inherent availability of at least .999815. The inherent availability

shall be calculated based on the conditions specified in Section 3.4.1(a).

3.4.5 Portability. The ITWS software shall be portable to the extent that:

a. Porting it to another implementation of the OS and programming language on the same hardware platform shall satisfy all functional and performance requirements and 98% of the code must be portable without change, and

b. Porting it to another POSIX-compliant hardware platform shall satisfy all the functional and performance requirements and 95% of the code must be portable without change.

3.4.6 Fault Isolation. The ITWS shall provide fault isolation capability down to the LRU level.

3.4.7 Software Quality. The ITWS software quality, defined in terms of the number of unresolved software errors (6.2) at the completion of software qualification testing, shall be:

Software Error Category	Maximum Number of Unresolved Errors
1	Zero
2	1/70k machine instruction words (6.2)
3	1/35k machine instruction words

3.4.8 Not Used.

3.5 Test Tool (TT). A test support tool shall be developed: (1) to inject pre-recorded or synthetic data, and (2) to receive disseminated ITWS products, in the form and format of the ITWS external interfaces, and at real-time data rates. The tool may be used during formal testing where the live external interfaces are not available or desirable for testing purposes. The tool shall provide test data input signals necessary to validate system functional and performance requirements. The Government will supply data required for use during ITWS testing.

3.5.1 Supported Interfaces. The TT shall emulate the ITWS External Interfaces (excluding the NIMS interface), up to the maximum ITWS configuration. The configuration will be that associated with the maximum number of each type of ITWS external interface and provide the back-up data to test a single co-located SD's functional and performance requirements.

3.5.2 TT Hardware. The TT hardware shall emulate the physical interfaces to the ITWS for each interface identified in 3.5.1, except for the FBWTG. The physical interfaces shall provide for the injection or receipt of data IAW their respective ICDs

and/or IRDs hardware requirements. The hardware interfaces shall emulate the telecommunications links and other communications protocols of the actually deployed interfaces. The Contractor may propose and justify an alternative interface for use during initial Development Test and Evaluation (DT&E) factory testing.

3.5.3 TT Functionality. The TT shall provide the following capabilities.

a. Maintain a minimum of two (2) hours of data for each interface identified in 3.5.1.

b. Repeat the data values for any or all interfaces from the minimum set of data to a 72 hour set of data. This shall include the ability to copy the order of a set of data and then attach it to the end of the original set of data and with a new or automatically computed continuous time sequence.

c. Reserved.

d. A control console operated interactively during a test to regulate the flow of real-time data from one (1) or more of the input or to one (1) or more output interfaces. This capability shall include selecting data records by skipping forward or back to a specific time or to a specific record number or identifier.

e. A display, and a selectable formatted softcopy and/or hardcopy, which identifies the real-time data being interfaced (e.g., test case, interface name, start time of data), the data flow rate, the number of records passed from inception of the process, the direction of the data flow, the time event of the data record, etc. as the events occur.

f. A selectable formatted hardcopy and/or softcopy of the data being interfaced identified to the data elements noted above. The formatted hardcopy/softcopy capability shall also be used to output the contents of any set of catalogued data from the database.

g. Reserved.

h. Use the six (6) hour archived input data removable storage device and data as an initial input source for a set of TT data. Data shall be selectable by time span.

i. Display a catalogue of the data being stored on the TT. The TT shall have the capability to selectively copy any test case to an external removable storage device, which

is compatible with the six (6) hour archived data device.

j. Software interfaces to emulate the telecommunications links and other communications protocols of the interfaces.

k. Time synchronize a set of input test case data into the ITWS processor during testing.

l. Record time synchronized output data from the ITWS processor during testing.

m. Selected logging of all or parts of a test, and the capability to review the data via softcopy or hardcopy.

n. Format at least six (6) test cases from existing test data.

3.5.4 Not Used.

3.6 Support Facilities

3.6.1 Not Used.

3.6.2 PSF. The ITWS PSF will be located in a Government furnished building assigned to the National Airways Systems Engineering Division, AOS-200, FAA Aeronautical Center. The ITWS PSF will include all of the equipment, supporting software, and documentation required for the development, maintenance, testing, analysis, and debugging of all ITWS functional programs.

3.6.2.1 Support Computers

3.6.2.1.1 Functions Supported. The ITWS PSF support computers shall have the capacity for two (2) basic types of activities:

a. Running the ITWS software using the recorded input data and products in a play-back mode, and

b. Developing, testing, and executing software for both operational and off-line analysis purposes, including (but not limited to):

(1) Text editing and printing,

(2) Program assembly or compilation,

(3) Program linking or loading,

(4) Running standard data analysis utilities,

(5) Running functional programs with and without simulated input, and

(6) Designing, testing, and debugging.

Activities a and b, above, do not necessarily require the same computer hardware.

3.6.2.1.2 Performance. The computers shall have memory, storage, computational, and input/output capacity to perform the requirements described in Section 3.6.2.

3.6.2.1.3 Software Development and Test. Source software compilation shall execute at an average rate of at least 60 lines of system C/C++ per minute, for each of up to four (4) simultaneous users performing software development and testing activities.

3.6.2.1.4 Simultaneous Operation. Twenty percent (20%) degraded timeliness for each activity shall be allowed when two (2) types of activities, as described in Section 3.6.2.1.1, are performed simultaneously.

3.6.2.1.5 System Software Generation. The capability to compile operational software shall be provided in the PSF.

3.6.2.1.6 Support Computer Peripherals. The PSF computer system requirements include all those peripheral devices, communication lines, and corresponding control software necessary for the system users to perform the required input data and products playback and software development activities. Specific requirements are detailed in Sections 3.6.2.1.6.1 through 3.6.2.1.6.3.

3.6.2.1.6.1 Interactive Video Displays. The PSF shall include at least four (4) interactive video display terminals for the control and execution of PSF functions and applications.

3.6.2.1.6.2 Mass Storage. The PSF shall include read/write mass storage, with the capacity to store all PSF applications and operating system software and at least 24 hours of both input data and products data.

3.6.2.1.6.3 Printer. The PSF shall include at least one (1) printer unit, with a minimum printing rate of 600 lines (132 characters per line) per minute.

3.6.2.1.7 Not Used.

3.6.2.1.8 Expandability. The PSF shall include the CPU, input/output device, and memory resources required for the expansion of the PSF to at least twice the specified number of each class of peripheral device (i.e., interactive video displays, mass storage, and printer).

3.7 Not Used.

(This Page Intentionally Left Blank)

4. QUALIFICATION REQUIREMENTS

4.1 Test Planning/Procedures. The test and evaluation process shall be used to insure that the Contractor has met and implemented the requirements of the ITWS specification, associated interface requirements and control documents, and algorithm description. The Contractor shall perform the requirements verification IAW the Contract SOW.

4.2 Test Phases and Levels. The ITWS test efforts will consist of three (3) distinct test phases (different levels of testing will occur during each phase):

a. DT&E, Contractor conducted;

b. Operational Test and Evaluation (OT&E), Government conducted; and

c. Production Acceptance Test and Evaluation (PAT&E), Contractor conducted.

4.2.1 DT&E Phase. DT&E is Contractor conducted testing held primarily to assist in the engineering design and development process by determining incrementally the degree to which functional engineering specifications are attained. Verification shall proceed from the unit level through integrated verification of functional areas and interfaces within the complete system, and to the complete system, in as near an operational configuration and environment as practical.

DT&E includes test and evaluation of subsystem hardware and software on full-scale engineering models. National Airspace System (NAS) interface requirements are tested during DT&E. First Article qualification testing will be performed during DT&E.

The DT&E shall verify that the system is designed to optimize human performance parameters with the intended user, system operator, and system maintainer population.

4.2.1.1 Not used.

4.2.1.2 Not used.

4.2.1.3 Factory Acceptance Test (FAT). The ITWS FAT, comprising full system and external interface testing, shall be conducted at the Contractor's facility. All testing shall be conducted according to Government approved test plans, test cases, and test procedures. FAT shall be conducted by the Contractor and witnessed by an authorized Government representative. FAT testing will be the basis for determining compliance of external interface requirements, and operational and system dependent performance requirements. The Worst Case test cases shall be used for performance testing (e.g. response time processing).

4.2.1.4 Site Acceptance Test (SAT). The ITWS SAT shall verify the capability of the ITWS to meet physical, functional, interface and performance requirements of the ITWS specification with live interfaces. SAT also includes those test requirements, which are best suited to an ITWS operational environment (e.g., stress, loading, live interfaces), or GFE (e.g., maintenance facilities, special interfaces, environmental factors) to complete qualification testing and system verification. SAT shall be conducted at all production sites.

4.2.2 OT&E Phase. The OT&E phase is the FAA-conducted, Contractor-supported, evaluation of the system operational effectiveness and suitability; including compatibility, interoperability, degraded operations, maintainability, and supportability. OT&E also identifies any deficiencies in NAS hardware, software, human performance factors, or operational concepts. It encompasses an interactive process of risk reduction demonstrations and analyses and ensures that NAS functionality (as it existed prior to the installation of the ITWS) is not degraded. OT&E is the combination of Integration Testing, Operational Testing, and Shakedown Testing.

4.2.2.1 Integration Testing. Integration Testing consists of testing NAS system end-to-end performance. This testing establishes NAS baseline performance (end-to-end), or verifies that previously existing NAS performance has not been degraded. To the greatest extent possible, the ITWS will be tested in a NAS equivalent environment.

4.2.2.2 Operational Testing. Operational testing verifies the operational effectiveness and suitability of the equipment with user participation in the evaluation. To the greatest extent possible, operational effectiveness and suitability will have been tested and presented to users during DT&E FAT and DT&E SAT. Aspects of this testing are further defined as follows:

a. Collecting data over the period of OT&E testing to support reliability and maintainability calculations,

b. Degraded operations and operational utilization

scenarios,

c. Stress and NAS loading testing of all interoperable subsystems,

d. Human Factors,

e. Safety and security,

f. Site adaptation, and

g. Transition and switch-over.

4.2.2.3 Shakedown Testing. Shakedown testing is the independent verification and validation conducted by the user organizations to verify operational effectiveness and suitability, including supportability and maintainability of the ITWS system in the NAS.

4.2.3 PAT&E Phase. The PAT&E phase is Contractor-conducted testing, performed on each delivered item. The objectives of this test phase are to verify that end items conform to applicable specifications, including any additional requirements or re-testing as a result of OT&E testing, that the system is free from manufacturing defects, and that the system is substantially identical to the qualified hardware and software.

4.2.3.1 Factory Acceptance Test (FAT). A PAT&E FAT is conducted by the Contractor at the factory for each delivered item. Hardware burn-in, site specific adaptation data, and system configuration verification are examples of PAT&E FAT testing.

4.2.3.2 Site Acceptance Test (SAT). A PAT&E SAT is performed at each field site before FAA acceptance of the ITWS system. Portions of the validated DT&E FAT and SAT procedures, including any additional requirements or re-testing as a result of OT&E testing, constitute the PAT&E SAT test conducted at each field site.

4.3 Qualification/Verification Methods. All ITWS development will undergo test and evaluation to verify that the ITWS meets system specification requirements. The verification methods noted below are mandatory for ITWS requirements verification.

4.3.1 Inspection

4.3.1.1 Hardware. Inspection of hardware shall include verifying physical characteristics to determine compliance with requirements without the use of special laboratory equipment, procedures, items, or services. Inspection shall verify workmanship, physical condition, construction features, and

document/drawing compliance. For COTS hardware, use of manufacturer's published materials, which contain test conformance information pertaining to commercial reliability test data, Office of Safety Health Administration regulations, Military Standards or Federal Communications Commission licensing are acceptable for qualification testing.

4.3.1.2 Software. Inspection shall be a non-destructive examination that includes review of software source and object listings to verify compliance with software documentation, requirements, and coding standards, as well as verification of the implementation of required algorithms. Software inspection shall not incorporate use of laboratory equipment or procedures to determine compliance with requirements.

4.3.2 Test

4.3.2.1 Hardware. Hardware testing shall measure hardware performance during or after the controlled application of functional and/or environmental stimuli. Measurements require the use of laboratory equipment, procedures, items, and/or services.

4.3.2.2 Software. Software testing shall employ technical means, including evaluation of functional operation by use of special equipment or instrumentation and/or simulation techniques, to determine compliance of the system with requirements. Data derived from software testing shall be reduced for analysis of software/system performance under the test specified.

4.3.3 Demonstration. The Demonstration verification method is used to indicate a general "pass/fail" condition.

4.3.3.1 Hardware. Hardware demonstration shall determine the qualitative characteristics of end-item or component properties by observation. Demonstration shall not require special test equipment or instruction to vary characteristics such as operational performance, human engineering features, service, access features, and transportability.

4.3.3.2 Software. Software demonstration shall determine compliance with requirements (e.g., the proper response at a site as a result of a specified interrogation or command to be processed by the program) through observation of functional operation. Demonstration shall be used primarily for activities where data gathering is not appropriate, such as display image verification.

4.3.4 Analysis

4.3.4.1 Hardware. Hardware analysis shall encompass any or all of the following:

a. Engineering Analysis is usually an engineering design function involving study, calculation, or modeling of the known or potential failure modes, and reaction or interactions of the specified parts, materials, and the design configuration with the known function, performance and/or probable effects of the operational environments.

   This analysis is normally used to verify margin when it is not desirable to test to failure.

b. Similarity Analysis is a method applied to end-items or components that are identical in design and manufacturing processes to end-items or components that have been previously qualified to equivalent or more stringent requirements. This method can be applied to COTS equipment for the same manufacturer's models based upon the manufacturer's engineering specifications. For COTS equipment, use of manufacturer's published materials which contain test conformance information relating to materials construction, commercial reliability test data, internal performance capabilities and environmental conditions (heat, power consumption, etc.) are acceptable for qualification testing.

c. Validation of Records Analysis is a method of verification wherein manufacturing records are used to verify compliance of concealed construction features or processes of manufacturing (e.g., vendor items). This method shall be applied to COTS equipment for the same manufacturer's models based upon the manufacturer's engineering specifications.

4.3.4.2 Software. Software analysis shall encompass the processing of accumulated results and conclusions to provide proof that the verification of requirements has been accomplished. The analytical results may be composed of interpretation of existing information or derived from lower level tests, demonstrations, analyses, or examinations.

4.4 Verification Requirements Traceability Matrix (VRTM). The VRTM, in accordance with the approved ITWS Master Test Plan, defines the verification method to be used to validate each ITWS specification requirement in the indicated test phase and level. Formal verification tests shall encompass the following range of conditions, when applicable:

a. normal data flow or condition,

b. minimum and maximum conditions,

c. below minimum and above maximum conditions, and

d. system failures and recovery.

5. RESERVED

(This Page Intentionally Left Blank)

6. NOTES

6.1 Acronyms and Abbreviations.

A

ADAS	AWOS Data Acquisition System
ANSI	American National Standards Institute
AP	Anomalous Propagation
ARTCC	Air Route Traffic Control Center
ASOS	Automated Surface Observing System
ASR-9	Airport Surveillance Radar-Model 9
ASR-11	Digital Airport Surveillance Radar (DASR) – Model 11
ATC	Air Traffic Control
ATCSCC	Air Traffic Control System Command Center
ATCT	Airport Traffic Control Tower
ATIS	Automatic Terminal Information Service
AWOS	Automated Weather Observing System

B

bps	bits-per-second

C

CAS	Commercially Available Software
CERAP	Center Radar Approach Control
CF	Contrast Factor
CHI	Computer/Human Interface
COTS	Commercial Off-The-Shelf
CPU	Central Processing Unit
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
CWSU	Center Weather Service Unit

D

DASR	Digital Airport Surveillance Radar
deg	Degree(s)
DFU	Display Functional Unit
DOT	Department of Transportation
DQT	Design Qualification Test
DT&E	Development Test and Evaluation

E

F

FAA	Federal Aviation Administration
FAAAC	FAA Academy
FAATC	FAA Technical Center
FAT	Factory Acceptance Test
FBWTG	FAA Bulk Weather Telecommunications Gateway
ft	Feet
FQT	Formal Qualification Test

G

GFE	Government Furnished Equipment
GSD	Geographic Situation Display
GUI	Graphical User Interface

H

Hz	Hertz (i.e., cycles per second)

I

IAW	In Accordance With
ICD	Interface Control Document
in	Inch(es)
IR	Interface Requirement
IRD	Interface Requirements Document
ISO	International Standards Organization
ITWS	Integrated Terminal Weather System

J

K

k	1,000
kg/m^2	Kilograms per square meter

L

LAPB	Link Access Protocol Balanced
lb/ft^2	Pounds per square foot
LLWAS	Low Level Wind Shear Alert System
LRU	Line Replaceable Unit

M

MDCRS	Meteorological Data Collection and Reporting System
MDT	Maintenance Data Terminal
min	Minute(s)
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair

N

NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NEXRAD	Next-Generation Weather Radar
NCEP	National Centers for Environmental Prediction
NFU	NWS Filter Unit
NIMS	NAS Infrastructure Management System
NIMS PA	NIMS Proxy Agent
NLDN	National Lightning Detection Network
nm	Nautical Mile
NWS	National Weather Service

O

OS	Operating System
OT&E	Operational Test and Evaluation

P

PAT&E	Production Acceptance Test and Evaluation
PC	Personal Computer
PD	Product Display
PG	Product Generator
POSIX	Portable Operating Systems Interface to UNIX
Precip.	Precipitation
PSF	Program Support Facility
PSN	Packet Switching Network

Q

R

RBDT	Ribbon Display Terminal
RFP	Request for Proposal
RMMS	Remote Maintenance Monitoring System
RMS	Remote Monitoring Subsystem
RPG	Radar Products Generator
RUC	Rapid Update Cycle

S

SAT	Site Acceptance Test
SCSI	Small Computer Systems Interface
SD	Situation Display
sec	Second(s)
SOW	Statement of Work

T

TBD	To Be Determined
TCWF	Terminal Convective Weather Forecast
TDWR	Terminal Doppler Weather Radar
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control Facility
TT	Test Tool
TWIP	Terminal Weather Information for Pilots

U

UTC	Universal Coordinated Time

V

VNTSC	Volpe National Transportation Systems Center
VRTM	Verification Requirements Traceability Matrix

W

X

Y

Z

6.2 Definitions.

Adaptation Data: Data and parameters used to tailor the ITWS system functionality. Includes (but is not limited to) product generation algorithm parameters and display configuration parameters. There are three (3) types of adaptation data: field-settable, site-specific, and user-settable (each is defined below).

Airport Lightning Warning Product: Warns users to the presence of lightning, primarily cloud-to-ground lightning, near a specified location. This information may be used by ATC personnel to determine when to switch to back-up generator power and by airlines to support decisions with respect to refueling and other ground operations.

Airport Wind: The wind as measured at an airport's primary wind sensor. For ITWS airports, the primary wind sensor is the ASOS for those airports that do not have an LLWAS III. The ASOS provides a two minute average of the wind and gusts to the TDWR in the same 52-character format used by LLWAS II.

Alert (Tornado) Product: Alerts ATC personnel to the presence of tornado(s) at the ITWS airport(s) that are within the coverage area selected at the SD.

Anomalous Propagation (AP): A phenomenon in which a radar beam is deflected from its normal straight-line path due to atmospheric conditions such as temperature inversion or rapid change in humidity with height. The term is most often used in association with (1) conditions such that the radar return indicates that there is precipitation present where in fact there is none, and (2) conditions such that the radar return indicates no precipitation present where in fact there is some.

Anomalous Propagation (AP) Alert Product: Alerts ATC personnel to the presence of AP ground clutter within the coverage area of the ASR(s) associated with the airport.

Blanking Alarm Period: The adaptable time interval that the RBDT audible alarm will sound once RBDT blanking occurs.

Character Graphics (Terminal Weather Text Message) Product: This product provides a (crude) graphical depiction of operationally significant weather near the airport for display on character graphics printers such as are found in some air carrier aircraft. The ITWS products graphically depicted are microbursts, gust fronts, and precipitation with storm motion indicated by a text message at the bottom of the display. This product provides improved situational awareness for pilots and

reduces the need for pilot/controller discussions about the terminal weather.

Cornerposts: The geographical regions associated with airport terminal arrival routes through which planes transition from enroute airspace into terminal airspace.

Data Link User: Organizations that obtain the Terminal Weather Information for Pilots (TWIP) function messages and transmit them to pilots. These messages are the Terminal Weather Character Graphics and the Terminal Weather Text Message.

Detection (Tornado) Product: Shows the location of tornadoes detected by the NEXRAD radar. This Product may be used to plan air routes that will keep aircraft away from tornadoes near the airport and to warn ATC personnel when to vacate the control tower.

Display Functional Unit (DFU): DFU is a term used in the TDWR system. A DFU is composed of one (1) TDWR GSD and zero (0) to eight (8) ribbon displays.

Ethernet: The standards for Ethernet include ISO/IEC 8802-2 and 8802-3. The data link protocol conforms to IETF Standard 41, RFC-894.

Field-Settable Adaptation Data: Modifiable in the field (at an ITWS site) at the MDT or SD, as appropriate. Changes affect only the particular ITWS, or the particular SD unless otherwise specified, for which the changes are made.

Gridded Wind Field: A data set, based on numerical weather models, describing analyzed or forecast winds in a three (3)-dimensional geographic area. The geographic area is defined by grid points regularly-spaced in the horizontal and generally at multiple vertical levels, e.g. 2,000, 5,000, and 8,000 feet of altitude (or, alternatively, 950, 850, and 750 millibars of pressure).

Gridded Wind Field Product: Provides a current high resolution three (3)-dimensional grid of the horizontal winds for use in wind shift estimation, the wind profile product, and for aircraft trajectory calculations. This product is not displayable on the SD.

Gust Front Detection and Forecast Product: Detects gust front location and strength and provides planning guidance through the forecasts of future gust positions. Gust fronts may contain wind shears that are potentially hazardous to landing and departing aircraft.

Gust Front Impact (Timer) Product: Provides an estimate of the time at which gust fronts will impact the airport. This product may be used for airport operations and runway configuration planning.

Gust Front Wind Shift Estimate Product: Provides an estimate of the speed (in knots) and direction of the wind approximately 10 minutes behind the gust front. This information may be used by ATC personnel to anticipate wind shifts and plan changes in runway configurations.

Inherent Availability: A measure of the probability that an end item is in an operable state and capable of performing its required functions during any and all required operating times. It includes only the effects of an item design and its application, and assumes an ideal operation and support environment.

Internet Protocol: The standard for IP is Standard 5, RFC-791.

IP Network: A GFE IP network will provide inter-facility communications for ITWS PG/SD, NFU/PG, and PG/external user 2 remote connectivity. Connectivity to the IP network will be generally to GFE routers via Ethernet. Where such routers are not provided GFE, the Contractor will install routers and provide a serial EIA-530 connection to the Government demarcation. IP Address assignments are provided as GFI.

Line Replaceable Unit (LRU): An LRU consists of one (1) or more electronic/mechanical subassemblies and assemblies, as defined in MIL-HDBK-505 and applicable parts of MIL-PRF-49506, and excludes most items falling under the definition for a part as given in MIL-HDBK-505.

LLWAS Winds Product: This product generates the centerfield and/or threshold winds data that is provided to flight crews to prepare for aircraft landings. The centerfield and threshold winds data are obtained from LLWAS sensors and are displayed on the SDs and their associated RBDTs for the active runways.

Machine Instruction Words: Instructions that computer hardware (a machine) can recognize and execute.

Mean-Time-Between-Failure: A basic measure of reliability for repairable items: The average number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Mean-Time-To-Repair: The total corrective maintenance time divided by the total number of corrective maintenance actions during a given period of time.

Microburst: A powerful downdraft of cold, heavy air occurring beneath a thunderstorm or cumulus cloud. As the downdraft reaches the Earth's surface, it spreads out horizontally in a burst of damaging winds on or near the ground. (Microbursts are significant to aviation because aircraft flying through a microburst at low altitude first encounter a strong headwind, then a downdraft, and finally a tailwind that produces a sharp reduction in airspeed and a sudden loss of lift.)

Microburst Alert ATIS (Timer) Product: Alerts users about microburst alerts at an airport and indicates the time remaining for the ATIS message to continue to mention microburst alerts. Provides guidance IAW established Air Traffic Procedures relative to the issuance and removal of advisories on the ATIS.

Microburst Detection/Prediction Product: Detects and predicts strong divergent outflows of wind near the ground surface generated from storm downdrafts. Provides situational awareness for airport operations planning and safety warnings to be provided to aircraft.

Precipitation (5 nm/TRACON/100 nm/200 nm Ranges) Product: Provides a representation of the location and intensity of weather in a user specified area. The intensity of the precipitation is described IAW the NWS six (6) level color scale. Precipitation data is useful for situational awareness and to aid ATC personnel by showing where weather is located relative to traffic flow patterns.

Precipitation With Anomalous Propagation (AP) Flagged Product: Shows the weather reflectivity for each ASR at an ITWS site with regions of AP ground clutter flagged.

Ribbon Display Alerts Product: This product provides alphanumeric messages for the active runways at an airport. These messages are displayed on RBDTs for dissemination to pilots IAW established Air Traffic procedures. The elements of the message for each runway include:

a. Operational Runway Identifier,

b. Wind shear information (type of alarm, estimated loss or gain, and operational runway location, if there are wind shear alerts), and

c. Threshold Winds.

Runway Configuration Product: Shows active runways at an airport and the allocation of these to RBDTs after a runway configuration change has been made for the information of other users at that airport. The runway configuration can be inferred

by users not at that airport (e.g., ARTCC users) by viewing the Ribbon Display Alerts Product which shows all of the active runways.

Site-Specific Adaptation Data: Pertaining to a particular ITWS site. Site-specific adaptation data is delivered to a site, and cannot be changed at the site.

Software Errors: Software capability requirements are defined in terms of the number of unresolved errors as a function of their category. A software error is an occurrence during the execution of a program, attributable to software, of failure to perform as specified. Documentation errors which cause a performance failure shall be counted as software errors.

a. Category 1 - An error which prevents an operational function from performing as defined in applicable specifications (e.g. causes a program to stop, an unusable product, or no product).

b. Category 2 - An error which degrades the performance of an operational function as defined in applicable specifications and for which a reasonable alternative work-around solution exists. (Reloading or restarting the program is not an acceptable work-around solution.)

c. Category 3 - All other errors, including those which cause operator inconvenience or annoyance but do not affect required operational functions, and intermittent errors. (An intermittent error is an error which cannot be reproduced consistently when the same procedure and environment are duplicated.)

Storm Cell Information (5 nm/TRACON/100 nm/200 nm Ranges) Product: Displays the storm cell information (i.e., echo tops (in k feet) and the presence of lightning activity, hail, and/or severe storm circulations) for active storm cells. Cells are local maxima of precipitation that are at or above a storm threshold.

Storm Motion and Extrapolated Position (5 nm/TRACON/100 nm/200 nm Ranges) Product: Provides ATC personnel with an indication of the speed and direction (i.e., motion) of storms in the area. The leading-edge contours of cells (i.e., local maxima of precipitation that are at or above the storm threshold) or cell groups are also displayed. These contours are extrapolated to indicate the likely positions of the cells at certain times into the future. ATC personnel may use these extrapolations to estimate the impact times of fast-moving storms. This Product, when used in conjunction with the Precipitation Product, aids ATC personnel in anticipating the need for runway and airspace configuration changes.

Terminal Convective Weather Forecast (TCWF) Product: This product generates graphical depictions of current convective weather and forecasts of the future weather locations for forecast times up to 1 hour.

Text (Terminal Weather Text Message) Product: This message is issued for each airport associated with a SD and describes the current or expected (near future) weather activity near the airport. The following elements are contained in each message: Airport Identifier, UTC, Present Airport Weather, Present Terminal Weather, and Expected Weather. This product is intended for dissemination to pilots via data links to improve situational awareness of terminal weather and to reduce pilot/controller discussions about terminal weather.

User-Settable Adaptation Data: Modifiable at an SD, by a display user. Changes affect only the SD at which the changes are entered. Considered an operational capability (not a maintenance action).

Watchdog Timer Interval: The adaptable time interval in which the RBDT has not received data from the SD before RBDT blanking occurs.

Wind Profile Product: Displays the current winds at various selected altitudes and locations to assist in traffic flow management. The winds data is obtained from the gridded winds product.

Wind Shear: Change in wind direction or speed over a given distance.

Wind Shear Alert ATIS (Timer) Product: Alerts users about wind shear alerts at an airport and indicates the time remaining for the ATIS message to continue to mention wind shear alerts. Provides guidance IAW established Air Traffic Procedures relative to the issuance and removal of advisories on the ATIS.

(This Page Intentionally Left Blank)